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NOTES ON PLANT MONSTROSITIES.

BY IDA A. KELLER.

In one of his " Physiologischen Notizen,"[1] Professor Sachs forcibly calls attention to the exaggerated and erroneous morphological significance which has been attributed to monstrosities. He contends that monstrosities are simply monstrosities and not "suggestions" as to the typical morphological nature of organs as implied constantly by the teachings of the present day morphology.[2] He urges that it is but proper to regard them as the result of a contest between normal tendencies and accidental external agencies. His final and emphatic verdict is: "Monstrosities represent a chaos without law and order."[3] Professor Goebel takes the same point of view, stating that most of the results obtained thus far in the field of teratology must be regarded as useless; the method of reasoning from that which is deformed to that which is normal is a mistaken one.[4] He indicates the direction in which this important branch of botany should be developed when he says: "The problem of this science is not to seek in deformities 'revelations' of nature but to explain how these deformities have come to pass."

At all events deformities in plants are extremely interesting. Although there can be no doubt that the investigator should above all things seek the explanations of their causes, yet in the present state of our science it is impossible to discover in most cases the reasons for their occurrence, especially if the disturbance is purely a local one. Descriptions of individual cases will probably prove of value in preparing the way for future generalizations.

Two rather interesting abnormal growths came directly under my notice some time ago. One was found on a shoot of our common garden woodbine, *Lonicera Japonica* Thunb. Plate V, fig. 1, represents the abnormal branch. It can readily be seen that the monstrosity was produced by the growing together of the terminating leaf-pair, or, according to botanical terminology, the leaves had become "connate." It was evident that the activity of the growing point had been suppressed, but it is a question not easily decided whether this suppression primarily caused the deformity by interfering with the normal cell development, or if the center of the disturbance is to be found in the unusual leaf development which thus might have destroyed the activity at the "punctum vegetationis." The abnormal growth had the shape of a cornucopia which was perfectly hollow, and in which every trace of the terminal bud was effaced. The plant was producing shoots at all available points, the normal shoots having an appearance such as is represented in Plate V, fig. 3. These were growing so rapidly in length that long before the young leaves had arrived at maturity, the growing point had advanced considerably beyond them. A glance at the figure although little can be gleaned from it so far as the cause of the disturbance is concerned, will give an idea as to its further effect. The impetus derived from the external favorable conditions of the season which found expression in the luxuriant growth at all parts of the vine, was directed to the pair of leaves below the monstrosity, and at this point a branch emerged; the nearest bit of meristem thus became infused with increased activity and the nourishment supplied was turned aside from its original path and sent in a new direction. Below the deformity the branch had, however, continued to grow in thickness. The abnormal growth was at first evidently purely a local disturbance, there being absolutely nothing unhealthy about the rest of the shoot as is found so often in cases of fasciations due to irregular nourishment or other causes. As already suggested, it will be a difficult matter to decide upon the true and full significance of a monstrosity in each particular case. A single instance as the one described above, will hardly warrant the assumption that it is the expression of a family trait or peculiarity found in allied species. The temptation is great, no doubt, to see in this case a tendency to connate growth to which we are accustomed in *Lonicera flava* and *L. Caprifolium* cropping out as a monstrosity in *L. Japonica.* It must be remembered, however, that it is far more usual to find that plants which ordinarily bear connate or perfoliate leaves (which we are accustomed to regard as later developments) will develop also some leaves which are simply sessile as e. g., *Uvularia perfoliata.* Thus it is that in monstrosities, so far as leaves are concerned, we expect "reversions to primitive types" rather than the acquirement of new characters.

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[1] Flora, 1893, Sachs. Ueber Wachsthumsperioden und Bildungsreize.
[2] Ibid, p. 222.
[3] Ibid, p. 233.
[4] Ibid, p. 233.

In the article referred to above, Sachs suggests that normal activity can only take place if all phenomena go on with mathematical exactness.[5] He forces one to realize that it is far more wonderful that nature proceeds with almost absolute regularity in the development of organs if we take into consideration the minuteness of the vegetative point and the quite incomprehensible precision with which molecules must travel each to its particular place of destination. He adds " a few molecules which stimulate the formation of anthers might be supposed to deviate the $\frac{1}{1000}$ part of a millimeter to the right or to the left of their prescribed path, or they might be delayed two or three minutes on their journey " and produce an abnormal growth. Thus it is that in the crowded condition of the floral organs at the growing point and because of the complex differentiation which must take place here at a very early period, that monstrosities in flowers are comparatively frequent.[6] Internal hereditary tendencies, no doubt, come to the fore-ground in a greater or less degree; certainly in the most pronounced manner in such cases e. g., as those cited by Sachs in the Iridaceæ where the inner circle of stamens reappears at times as an abnormal development, and thus the type of the Liliaceæ is repeated. Sachs maintains that we might regard the normal Iris type as a monstrosity.[7] It is quite apparent, however, that such distinctions will depend entirely on the accepted definition of the term monstrosity. It seems reasonable to suppose that the more complex the condition of an undeveloped tissue mass the greater the possible amount of displacement from the normal position, and the less marked externally will be the influence of hereditary tendencies. In undeveloped foliage leaves where the young parts are apt to exert less influence, and are in their turn less dependent on the condition of adjacent tissues we might, perhaps, expect at times to find in abnormal growths an innate tendency of an entire family.

I will describe in brief another and very different case of monstrosity observed at about the same time as the above. The plant was the common garden hydrangea, *Hydrangea hortensis* L. Near the end of a shoot and opposite a perfectly normal leaf, I noticed one which was composed of two distinct blades. These were united by the midrib from the base upward about half the length of the leaf, and from there on the blades were completely separated. Plate V, fig. 4, is a side view of the double leaf. It was interesting to note the pale surfaces, which form normally the lower side of the leaf, faced each other, while the shiny morphological upper surface of the upper blade was turned toward the sky, while in the lower blade this was turned to the earth. The lower blade then, so far as its morphological structure was concerned, was decidedly in a false position, otherwise, at least in its contour, no irregularity was noticeable, except, perhaps, that it was somewhat smaller than the opposite normal leaf, Plate V, fig. 7. The upper blade was correct as to its position, but its shape was deformed. It had two apices, the midrib having divided at the point of union of the two blades. Besides it was somewhat larger than the opposite normal leaf. The disturbance which caused this monstrosity was also purely a local one since the rest of the plant was in nowise remarkable. Evidently the growing point was twice induced to divide, first in producing two distinct blades, and again in the division of the midrib of the upper blade: A chaos this appears without law and order, and yet even in chaos there is a reason or cause for everything. It would certainly be worth while to know why the under surfaces of the two blades faced each other in such a way as to appear as mirrored images of one another.

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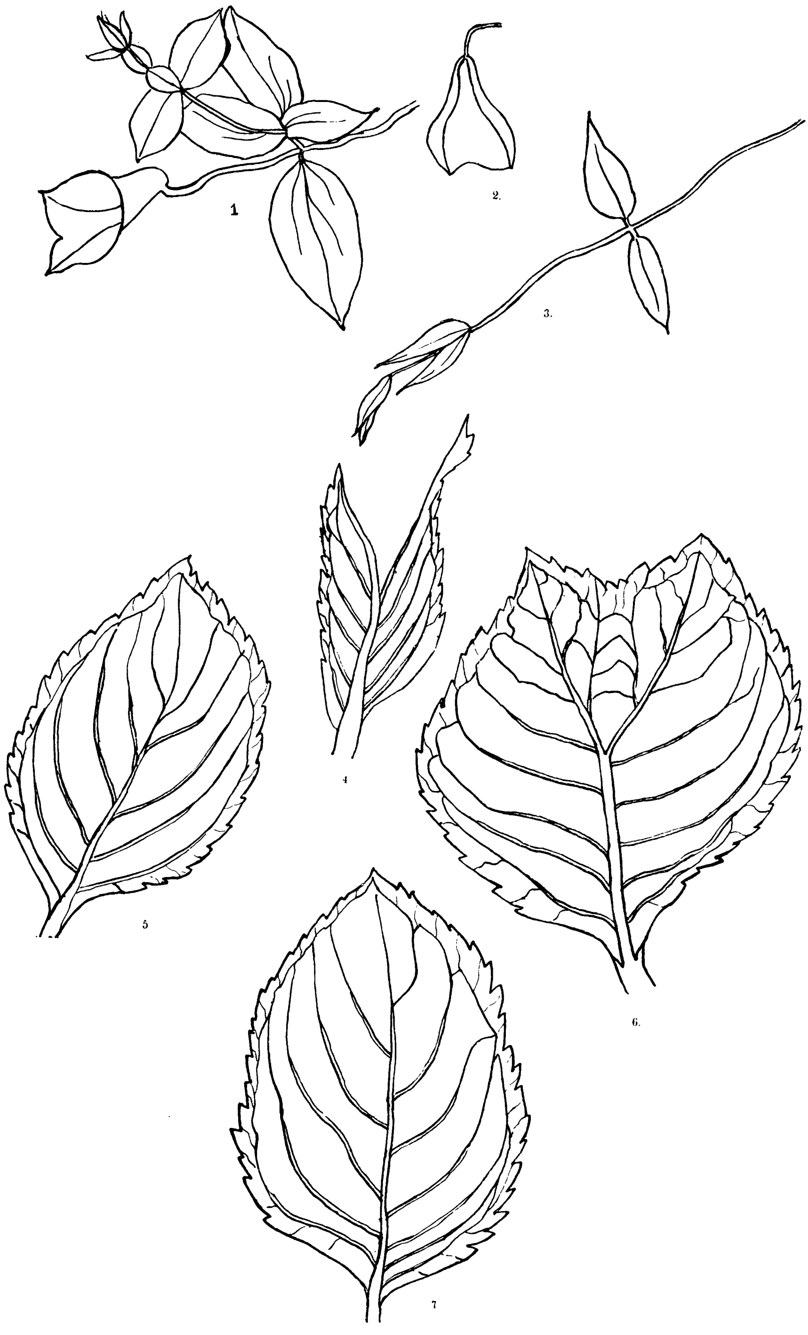
[5] Ibid. p. 236.
[6] Ibid, p. 235.
[7] Ibid. p. 234.



KELLER. PLANT MONSTROSITIES.